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Security Information**SOVIET SCIENTIFIC-TECHNICAL MANPOWER***Sov Sci***1. INTRODUCTION**

The Soviets have consistently regarded science and technology as the key to the attainment of their national economic and military goals. The organization of the government at the highest levels has been directed at supporting their scientific and technical objectives. Three key organizations--the Academy of Sciences, the Ministry of Higher Education, and the State Planning Commission--all report directly to the Council of Ministers and by virtue of their authority in this centralized governmental structure the Soviet leaders have been able to plan and to enforce nation-wide programs for scientific and technical education which have mobilized large human and material resources. As a result, the USSR has trained and is now training a large body of scientists and technicians which is increasing in size and in quality, and which warrants comparison with that possessed by the United States.

2. THE GENERAL QUALITY OF SOVIET SCIENTIFIC-TECHNICAL MANPOWER

The quality of Soviet scientific-technical manpower is uneven. The Soviet Union inherited from pre-Revolutionary times a nucleus of competent scientists and skilled workers but they lacked experience in the application of science to production. Soviet leaders early set the goal of a scientific-technical effort adequate for the attainment of their economic and military objectives. However, the first decade and a half of the Soviet period saw a general decline in the quality of Soviet scientific education and by the early thirties, after the rapid expansion during the first five-year plan, standards of performance in research and education

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had fallen to low levels. Soviet science and technology remained weak and the plants and production techniques established in the early and mid-thirties were largely direct importations. About 1933, Soviet leaders slowed the rate of increase in numbers of students entering scientific fields to enforce higher standards of quality. In higher educational institutions, courses were extended; discipline was strengthened; systems of examinations and advanced degrees were established; and science workers and instructors had to meet new requirements.

The Soviet Union continued to train scientists through World War II, though not at the level previously attained. Subsequent to World War II, with the realization of the contribution that science and technology had made to the strength of the West during the war, the Soviets greatly increased their efforts to improve their own science and technology

The force of the Soviet program of higher education is shown by the numbers of institutions and students. Since the Revolution, the numbers of Soviet higher educational institutions and their students, in all fields, have multiplied by about ten times, from 91 institutions with 112,000 students in 1918 to about 900 institutions with 1,100,000 full-time and 400,000 extension-course students at present.

Our latest information indicates that improving educational standards and increasing experience have raised the quality of Soviet scientific-technical personnel in most major fields to approach that of the United States. Current graduates in science from higher educational institutions have completed about fifteen years of intensive study with a generally far greater and more consistent emphasis on scientific subjects in secondary schools than is found in the United States.

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Careers in science and engineering in the Soviet Union are made especially desirable by the inducements of high salaries and social prestige, and attract the best students. Recent Soviet efforts in many fields, both in theory and in application of science, demonstrate a high degree of competence.

3. QUANTITATIVE MEASURES

It is possible to select certain comparatively well defined groups which are engaged either in scientific research and development or in related activities and which provide a fairly sound basis of comparison. The quantitative measures of Soviet and American scientific-technical manpower which are used here compare numbers of persons in mid-1953 on several bases. These are; graduates of higher educational institutions and holders of advanced degrees (the Soviet Kandidat and the American Ph.D); and workers in major scientific and technical fields. These fields are:

a. Physical Sciences

Physics
Chemistry
Mathematics
Metallurgy
Engineering (aeronautical, chemical, civil,
electrical, mechanical, etc.)
Astronomy
Meteorology
Geology and Geography
Other fields based on Physics, Chemistry, or
the Earth Sciences

b. Agricultural Sciences

Agriculture (Agronomy, Animal Husbandry, Forestry,
Entomology, etc.)
Biological sciences, other than those included
under "Health Sciences."

c. Health Sciences

Medicine and Medical Sciences
s Dentistry and Dental Sciences
Other fields supporting health and sanitation (excluding
Biological Sciences, other than those included under
"Agricultural Sciences"

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a. Comparison

] CHART 1 [

Chart 1 compares the total living graduates of higher educational institutions (colleges and universities) actually employed within the two countries in scientific and technical fields. This indicates that Soviet scientific-technical manpower resources compare in size with those of the United States, and also that the sizes of these major groups are quite similar.

] CHART 2 [

Chart 2 compares the number of graduates in scientific and technical fields with the total graduates in 1953 on a percentage basis. Soviet higher education lays a much heavier stress on science than is found in the United States. Over the past twenty years the proportion of Soviet graduates in scientific fields has varied between 70% and 44%, the current figure. Many of the Soviet graduates excluded from these percentages have been trained to teach science in the expanding secondary school program. During the same period in the United States the percentage of all graduates in scientific fields has held close to 30%.

] CHART 3 [

Chart 3 compares the annual numbers of persons graduating in scientific and technical fields in the USSR with those in the United States. The drop in Soviet graduates in 1933 followed a lengthening of courses of study, and the rapid rise around 1935

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was the consequence of expanded enrollments from 1930-1932. Both Soviet and the United States curves show war time losses and rapid post-war increases which, in the United States, under the action of the "GI Bill" reached a peak in 1950. Since that time graduation trends have favored the Soviet Union. Assuming that current trends in the proportion of graduates in scientific fields will continue, the recent rates of enrollment indicate a continual increase in numbers of science graduates for at least several more years.

] CHART 4 [

Chart 4 shows the numbers of persons now employed in scientific fields who hold the Soviet Kandidat degree and the American Ph.D. (which includes the Sc.D.) In terms of formal requirements, the Soviet degree of Kandidat is the near equivalent of the Ph.D. Although the total number of US Ph.D.'s considerably exceeds the number of Soviet Kandidats, 85% of the Soviet Kandidats and only one half of the American Ph.D.'s are in scientific fields.

In most comparisons, uncertainties of about ten percent are not unlikely. The data used in the calculations for the USSR are drawn from open Soviet literature--statistical year books (before 1940), journals and newspapers. Classified data for 1941, seized by the Germans and later published, agreed well with the information which had appeared in open publications.

All of the data for American graduates and holders of the Ph.D. degree were furnished by the Commission of Human Resources and Advanced Training of the National Research Council.

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4. TRENDS IN THE GROWTH OF SCIENTIFIC MANPOWER

Current rates of growth of the scientific-technical manpower groups are greater in the Soviet Union than in the United States. This is shown by the increase in numbers of graduates of higher educational institutions in scientific fields, and the numbers of holders of higher degrees. There are no indications that Soviet rates of growth will slacken. Present Soviet plans call for increasing numbers of graduates and higher degrees to be awarded. The continued high rates of expansion of the Soviet scientific-technical manpower show that Soviet leaders believe that by such expansion, they can improve their capabilities. This expansion will continue as long as the current program is clearly effective and profitable.

5. TRENDS IN THE QUALITY OF SCIENTIFIC MANPOWER

In science and technology there are generally two levels of education. The technician completes seven years of schooling followed by three to four years of technical study in the factory apprentice schools (FZO), or the Technicums. The scientist and engineer completes a ten year primary and secondary course followed by five to eight years of study in the higher educational institutions (VUZ's). At the end of this additional eight years, a Kandidat degree is received which approaches the level of an American Ph.D. or D.Sc.

The heavy stress upon science throughout the entire Soviet educational system has already been noted. It is apparent in the high percentage of graduates of higher educational institutions in scientific fields. A similar emphasis on science is found in the curricula of the secondary schools which are, to a large extent, standardized throughout the USSR, and appear to

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Those who are now graduating from higher educational institutions number only a few percent of their first class in primary school some fifteen years ago. Limited educational facilities have not permitted all of the others to even finish their secondary education. Some have left after primary school but most after the seven year school to go to work or to enter technical secondary schools. Students whose families cannot spare their earning power or who live too far from seven or ten year schools, as is frequent in rural areas, are unable to continue their education in these institutions. Among those who are not thus eliminated, scholastic ability is the main condition for continuing their education. In general, only more gifted and industrious students have survived to enter higher schools. In some cases nepotism and political activeness may have some influence. However, stipends and scholarships from the end of the seventh year are weighted to favor good students. Also, the resultant scholastic competition has been a strong factor in achieving and maintaining standards in upper secondary and higher education.

The Soviets are well aware of the deficiencies of the educational system and are devoting a great deal of attention to the problems of improving educational standards. With such official support, there will almost certainly be a continued rise in the quality of the Soviet scientific-professional class.

6. CONCLUSIONS

Despite the obvious uncertainties that attend predictions, consistent emphasis by the U.S.S.R. during recent years on scientific

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and technical training, and the reliable information regarding its attainments thus far, makes it reasonable to expect that the U.S.S.R. will continue to improve its position vis-a-vis the U.S. during the next 10-15 years.

This trend toward an unfavorable balance could be altered by a major increase in emphasis on scientific and technical training in the U.S. or by radical de-emphasis in the U.S.S.R. No basis for either assumption has been found, however, and in their absence, the following conclusions have been derived:

(1) Despite some differences, the general composition of Soviet scientific-technical manpower - i.e. the relative numbers of graduates and holders of higher degrees and the relative numbers of these persons in the physical, agricultural and health sciences - is basically similar to that of the United States.

(2) In general, the present quality of Soviet scientific-technical manpower compares favorably with that of the United States. While as previously noted the Soviets are weak in certain of the biological sciences, in the principal fields of physical science and engineering essential to building the national industrial and military strength, they now appear to be overtaking the West.

(3) If present trends continue, the size and total capabilities of the Soviet scientific and engineering manpower pool will exceed that of the United States within the near future.

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